

THE INCIDENCE OF AND RELATED
FACTORS CONCERNING EPILEPSY
IN MICHIGAN

C. L. ANDERSON



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*A dissertation submitted in partial fulfillment of the requirements
for the degree of Doctor of Public Health
University of Michigan*

1934.



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RECURRENT fits and attacks of unconsciousness have for centuries been regarded as a disease entity and variously called "the sacred disease" or epilepsy. According to its derivation from the Greek, the word "epilepsy" literally means "a seizure." Being merely descriptive of a clinical syndrome, the term is not wholly satisfactory, but it is still applied to recurrent fits and periods of unconsciousness, for no other more clearly descriptive word has been found.

Epilepsy has been recognized for at least twenty-five centuries. Hippocrates, born 460 B.C., made observations and descriptions of it that might take their place in the textbooks of to-day. And descriptions of epilepsy are found in the earliest historical records of disease, so that it is possible that even such ancient writings as those of Hippocrates are merely repetition of facts that were known to physicians in 3000 B.C.

As scientific knowledge has increased, the conception of the cause of epilepsy has undergone marked changes. During the early stages of civilization, the condition was attributed to the temporary loss of the soul from the body. In some regions it was attributed to the possession of the body by some demon or other malignant spirit. In primitive countries such beliefs still exist among the natives, who employ magic and religious rites to drive out the unwanted spirit. The concept of epilepsy as a contagious disease, which was common during the Middle Ages, is thought to have sprung from this ancient belief that the disorder was due to seizure by demons. Patients were strictly isolated and as late as the middle of the fifteenth century isolation hospitals for victims of epilepsy were still in existence.

The first statement that epilepsy is not a "sacred disease," but rather a disorder due to natural causes was made by Hippocrates. His contention was that the only reason for ascribing the condition to the gods was the fact that the nature of the disease was incomprehensible. He believed that seizures were connected with humidity of the brain. In the centuries that followed, various descriptions of epilepsy were added to the records, but there was little advance in the understanding of the disease until the advent of modern scientific methods of study.

Modern scientific research on the problem of epilepsy began during the nineteenth century. Experimentation comparable to that of to-day was applied to the problem of epilepsy by Brown-Sequard, who published a report on the experimental production of this disorder in 1869 and 1870. At about the same time Hughlings Jackson, a young physician in London, was making important clinical observations. These finally led to the recognition of a special type of epilepsy which has come to be known as Jacksonian. There is no single complete and satisfactory description of this by Hughlings Jackson himself, but his various clinical reports and discussions contain all the data necessary for a full description of the disorder. With the advance of science since the time of these two investigators have come many suggestions relating to the etiology and therapeutics of epilepsy. Heredity, alcoholism, infection, lesions in the central nervous system, dysfunction of the endocrine glands, digestive disorders, mechanical pressure, and many other factors have been held responsible for epileptic attacks, although no adequate indication of the fundamental etiological role of any single or multiple factor has been demonstrated.

The literature relating to epilepsy reveals that, despite the importance of the disorder, the extent of research resulting in conclusive findings is so meager as to suggest that the study of it has scarcely begun.

The syndrome commonly called epilepsy is a chronic disorder characterized by fits or attacks in which there is loss of consciousness, with a succession of tonic or clonic convulsions.

The "grand mal" attacks are typical convulsive seizures, having the following characteristics:

1. Prodromata, generally of a sensory character. At times there is a vasomotor or psychic disturbance.
2. Initial cry, shrill and startling.
3. Very sudden loss of consciousness.
4. Pupils dilated, do not react to light. The eyes remain open at the beginning of the seizure.
5. Tonic, then clonic spasm of muscles (unilateral, partial, general).
6. Spasm of respiratory muscles which may lead to asphyxia.
7. Spasm of the muscles of the jaw (biting of the tongue, bloody foam).
8. Relaxation of spasm with movements becoming clonic and then intermittent.
9. Prolonged stupor or profound sleep; gradual recovery of consciousness.

The active convulsive seizure lasts but a few minutes. The deep reflexes may be diminished or increased.

Some of these symptoms may be absent in typical attacks. The most constant symptoms are the loss of consciousness, the dilatation of the pupils, the spasm of the muscles, and the stupor or sleep after the convulsive movements have ceased. The diagnosis cannot safely be made unless at least two of these symptoms are definitely present.

The typical minor attacks (*petit mal*) are characterized by a very transitory loss of consciousness without any muscular twitchings and without any other symptom. Unfortunately, these minor spells lead, often enough, to major epileptic attacks.

Because of its somewhat dramatic nature, epilepsy is regarded by the general lay public with many fanciful misconceptions and misinterpretations based upon sheer empirical observation of isolated cases. And this tendency to draw unwarranted conclusions in regard to epilepsy and epileptics is not confined to the lay public, for various writers, even in the field of science, without adequate data and sufficient evidence, have drawn conclusions that detailed study has proved entirely foreign to the facts. The paucity of available data relating to the various factors and phases of epilepsy can be attributed largely, on the one hand, to the difficulty of obtain-

ing adequate knowledge and data both quantitatively and qualitatively and, on the other hand, to the failure of the public to appreciate the significance of the position of the epileptic in society, both from the standpoint of the social welfare and the well-being of the epileptic himself.

The position of the epileptic in society is a most unfortunate one. Between seizures he may apparently be perfectly normal in all respects, but the attitude of his associates is conditioned by the picture of those short intervals in which seizures occur. In consequence, he often becomes an object of solicitude. Or he may be left as a detached unit of the social picture in which he finds himself. This anomalous position and its relation to various problems, as well as the high mortality rate of the disorder, indicate the importance of the affliction from the point of view both of the individual and of society.

EPILEPSY IN MICHIGAN

The purpose of the present paper is to analyze the data relating to epilepsy in the state of Michigan, with special reference to factors of significance to public health, medical research, social welfare, state administration, education, mental hygiene, and general public welfare. Naturally, it is not possible for a study of this length to exhaust the field, but the aim is to offer data that may be of value in the further study of the many problems that epilepsy presents.

Material was obtained from the following institutions: (1) the state colony for epileptics; (2) the state hospitals for mental disorders; (3) the institutions for the mentally defective; (4) the penal institutions; and (5) the county infirmaries. In addition, a study was made of the general population in one section of the state, to obtain data relating to epilepsy in the general population.

At the state colony for epileptics data were obtained from the family and personal histories of the patients and from the medical case records of the institution's staff. Virtually all the cases here are of the major type if the three symptoms, unconsciousness, spasm of the muscles, and stupor, or sleep, are to be accepted as criteria.

Data relating to epileptics in hospitals for mental disorders were obtained from the medical case records of the Ypsi-

Ionia, Kalamazoo, Pontiac, Traverse City, Newberry, Eloise, and Ionia hospitals as certified by the medical superintendent of each institution.

In the institutions for the mentally defective, the Michigan Home and Training School at Lapeer and the Training School at Northville, data were obtained from the medical records of the institutions.

The penal institutions at Jackson, Ionia, and Marquette had adequate medical records from which the desired data could be obtained.

In the case of county infirmaries, data were obtained from the records of the superintendents of the poor. While not a reliable source, it was the only one available.

In an attempt to arrive at the extent of epilepsy in the general population, a thorough survey was made of nine counties in the northeastern portion of the lower peninsula. This section was selected because of excellent contacts with individuals, officials, agencies, and so forth. Because epilepsy is often regarded as a disgrace, families attempt to hide its presence within the relationship. For this reason the approach to a survey of epilepsy must be carried on along lines different from those ordinarily followed in surveys of disease. In this study, information was obtained from physicians, health agencies, nurses, social workers, probate judges, school commissioners, teachers, clergymen, old residents, and members of county child-health committees. These child-health committees are composed of at least three women from each township in a county and they were an excellent source of information. Any cases not reported by a physician were rechecked to verify the affliction as epilepsy. Wherever doubt existed, the case was not accepted as epilepsy.

The Michigan Farm Colony for Epileptics—This colony was established under authority of Act 173, P.A. 1913, "for the humane, curative, scientific, and economical treatment of epileptic persons, exclusive of the insane and idiotic." The site, consisting of 1,510 acres of land, is located at Wahjamega in Tuscola County, four miles from Caro and eleven miles from Vassar. The institution has a receiving hospital and nine cottages for patients with a total capacity to care for slightly less than 1,000 persons.

The average population of the institution has ranged from 135 in 1915, the first full hospital year, to 856 in 1932. At the time of this study, there were 1,002 residence and vacation patients in the institution, of whom 78 had been there less than one year, and 189 more than one year, but less than two years. An analysis on a basis of five-year periods (Table I) gives a perspective of the tenure of residence of the colony group as a whole.

In analyzing the table, consideration must be given to the fact that the institution is not a long-established one. However, the fact that 35 per cent of the patients had been resi-

TABLE I.—RESIDENCE OF PATIENTS IN MICHIGAN FARM COLONY FOR EPILEPTICS, BY FIVE-YEAR PERIODS

<i>Residence</i>	<i>Number of patients</i>	<i>Per cent of total</i>
Less than 5 years.....	433	43
5 to 9 years.....	218	22
10 to 14 years.....	208	21
15 to 19 years.....	143	14
Total.	1,002	100

dents for ten years or more would indicate that the colony provides a congenial, kindly, homelike atmosphere where the epileptic may live in an environment to which he can permanently adapt himself.

Various classifications of the epilepsies have been made on an etiological basis. At the Michigan Farm Colony, entering patients, after a complete examination, are classified into four types. Of the patients in the colony at the time of the study, 85 per cent were classed as idiopathic, 7 per cent as traumatic, 5 per cent as symptomatic, and 3 per cent as hereditary.

A study of the marital condition of these colony patients (Table II) shows that 82 per cent were single, 11.5 per cent married, 2.6 per cent widowed, 3.5 per cent divorced, and 0.4 per cent separated.

Analysis revealed a disproportionately higher number of females than of males among the married, widowed, and divorced groups.

The composition of a colony population is dependent somewhat upon the ability of the institution to provide for the

various patients of different ages. At the Michigan Farm Colony inadequacy of plant and of personnel makes it impossible to institutionalize more than a limited number of children, especially children under ten years of age.

Division into age periods (Table III) was based on the age of the patient at the nearest birthday.

Specifically, the figures indicate the need of facilities at the Michigan Farm Colony for caring for patients in the lower age groups.

Because records relating to levels of intelligence were not available, it was not possible to study the comparative intel-

TABLE II.—CIVIL STATUS OF PATIENTS AT MICHIGAN FARM COLONY

<i>Civil status</i>	<i>Number of patients</i>	<i>Per cent of total</i>
Single.	821	82.0
Married.	115	11.5
Widowed.	27	2.6
Divorced.	35	3.5
Separated.	4	0.4
Total.	1,002	100.0

TABLE III.—AGE DISTRIBUTION OF MICHIGAN FARM COLONY POPULATION AS COMPARED WITH GENERAL POPULATION AND ALL EPILEPTICS IN INSTITUTIONS IN U. S., 1923

<i>Age group</i>	<i>Number of patients in colony</i>	<i>Per cent of total</i>	<i>Per cent of epileptics in institutions in U. S., 1923</i>	<i>Per cent of general population</i>
Under 5 years.	3	0.3	0.3	9.6
5 to 9 years.	16	1.6	2.2	10.1
10 to 14 years.	51	5.1	7.3	9.4
15 to 19 years.	111	11.0	10.0	8.6
20 to 24 years.	133	13.3	12.3	8.6
25 to 29 years.	116	11.6	11.2	8.6
30 to 34 years.	121	12.0	11.8	8.1
35 to 44 years.	176	17.6	20.2	15.1
45 to 54 years.	147	14.7	14.4	10.3
55 to 64 years.	93	9.3	6.4	6.4
65 to 74 years.	28	2.8	1.9*	3.7
75 years and over.	4	0.4	1.6†	1.5
Unknown.	3	0.3	0.5	0.1
Total.	1,002	100.0	100.0	100.0

* 65 to 69 years.

† 70 years and over.

ligence ratings of the colony patients. However, data relating to educational attainment were analyzed and evaluated on a basis of grade completed. It is recognized that this criterion is not the most desirable one, but it serves to give a general picture of the extent of education among epileptics.

Of the 963 patients at the colony whose educational history was obtained, 21.9 per cent had received no formal education whatever, 69.3 per cent left school some time during the first eight grades, 8.8 per cent went beyond the eighth grade, and less than 1 per cent (0.8) went beyond high school.

Two factors must be borne in mind in considering the educational attainment of these people. First, because of the nature of his disorder, the epileptic does not find the school a congenial place; hence there is little that attracts him to stay there. Secondly, as will be presented later, mental deficiency and mental deterioration are associates of the syndrome of epilepsy.

Analysis revealed that those counties that had active social agencies, both official and voluntary, had a proportionately greater number of patients at the farm colony than the counties without active agencies. The necessity for institutionalizing certain epileptics seems to be realized by too few of the general citizenry.

The composite rate for the state was 27 per 100,000 of the general population.

Of the colony population, 90.5 per cent were native born and 9.5 per cent were foreign born. When these figures are compared with those of Michigan's general population, of which 82 per cent are native born and 18 per cent foreign born, there would appear to be some significance in the variation, but, because of the large number of variables operative, there is actually very little significance. Epilepsy is largely a disorder of the young and but few of the foreign born are in the age groups under forty years.

In analyzing the significance of position in the family in relation to epilepsy, data showed that in the smaller family groups of two, three, four, and five children there appeared to be a tendency for the epileptic to be the first-born, but there is not sufficient evidence to attribute this tendency to anything more than mere chance. Possibly further study, taking all

variables into account, may attach some significance to this factor.

A study of the occupations of the fathers of the colony patients gave an indication of the economic status of these patients. In general, this group of fathers was composed largely of common laborers, semi-skilled and skilled wage earners, farmers, and tradesmen. A few professional and business men make up the remainder. On the whole, the group was fairly representative of the lower-income group in the general population.

In analyzing family histories it must be recognized that the information given is very often incomplete and inaccurate.

TABLE IV.—FREQUENCY OF EPILEPSY AND DISORDERS POSSIBLY ALLIED TO EPILEPSY IN FAMILY HISTORIES OF 452 PATIENTS

<i>Disorder</i>	<i>Number of occurrences in family histories</i>
Epilepsy.	236
Insanity.	122
Feeble-mindedness.	91
Chorea.	4
Paralysis.	22
Migraine.	82
Extreme nervousness	32
Syphilis.	14
Deafness, muteness, or blindness.	34
Alcoholism.	55

This was a factor considered in the study of the family histories of these patients, and in 185 cases the histories were rejected for one reason or another. Of the remaining 817 cases, 365, or 44.7 per cent, gave negative family histories.

The disorders reported in the family histories of the remaining 452 are listed in Table IV.

This table would seem to indicate that among epileptics, epilepsy appears more frequently in the family history than any of the other disorders listed. However, there is the possibility that only institutionalized cases of insanity and only cases of extreme feeble-mindedness, or idiocy, are usually recorded in histories.

Syphilis, which is often thought to be associated with family histories of epilepsy, appeared but 14 times in these histories.

Alcoholism also does not appear of much importance here. When only 55 cases appeared in the family histories of 817 epileptics, alcoholism can hardly be considered a likely causative factor. A better interpretation might be that alcoholism is evidence of an unstable or inadequate personality make-up and thus indicates a more fundamental factor as being of possible consequence.

Epilepsy itself, insanity, and feeble-mindedness occur with sufficient frequency to suggest that possibly a generally unstable or sensitive nervous system is the basic factor in the

TABLE V.—AGE OF FIRST SEIZURE OF 919 PATIENTS IN MICHIGAN FARM COLONY

<i>Age periods</i>	<i>Number of patients</i>	<i>Per cent of total</i>
Under 5 years.....	292	31.8
5 to 9.....	133	14.5
10 to 14.....	197	21.4
15 to 19.....	145	15.8
20 to 24.....	56	6.1
25 to 29.....	52	5.6
30 to 34.....	19	2.1
35 to 44.....	17	1.9
45 to 59.....	8	0.8
Total.	919	100.0

transmission of a condition which manifests itself in the syndrome known as epilepsy.

The data failed to show any appreciable general differences in the family histories of male and of female patients as regards these disorders. They did tend to show, however, that maternal disorders of this type are apt to manifest themselves more often than paternal defects, which is in general agreement with the findings of Thom.¹

Of the 1,002 patients at the farm colony, 163, or 16.3 per cent, had a family history of epilepsy. Possibly the actual percentage is higher than this, but it will hardly compare with the percentage obtained by Gowers, who reported two-thirds in his study.²

¹ "Epilepsy," by Douglas A. Thom, M.D. *Boston Medical and Surgical Journal*, Vol. 187, pp. 320-24, August 31, 1922.

² *Epilepsy and Other Chronic Convulsive Diseases; Their Causes, Symptoms, and Treatment*, by W. R. Gowers. London: 1901.

Of the patients at the colony, 58 per cent had negative histories so far as concerned physical disorders. As a whole, the histories of the remaining 42 per cent indicated that the physical disorders were closely identical with those found in the general population, with one noteworthy exception. It was observed that the incidence of disorders of the nervous system and of the special sense organs was unusually high. Thus, a total of 85 cases of paralysis, meningitis, and chorea were recorded and a total of 15 cases of deafness and blindness. This may indicate a relationship to the unstable or sensitive nervous system previously suggested.

TABLE VI.—FREQUENCY OF SEIZURES IN PATIENTS IN MICHIGAN FARM COLONY *

<i>Frequency of seizure</i>	<i>Number of patients</i>			<i>Per cent of total</i>
	Male	Female	Total	
More than 10 a day.....	6	4	10	1.0
2 to 10 a day.....	41	28	69	7.3
Daily.	35	32	67	7.1
5 to 20 a month.....	79	61	140	14.7
2 to 4 a month.....	164	165	329	34.7
1 every month.....	130	142	272	28.7
1 every 2 months.....	9	6	15	1.6
1 to 5 a year.....	16	30	46	4.9
Total.	480	468	948	100.0

* In 54 cases—49 males and 5 females—there was no record as to frequency of seizure.

Although the majority of colony patients were adults, it appeared that the onset of epilepsy occurred during childhood or youth.

Satisfactory data were available for 919 patients (Table V).

Taken by age periods, 31.8 per cent of the colony patients had their first epileptic seizures before the age of five. Further, in 83.5 per cent of the cases the onset of the disorder occurred before the twentieth year.

In general, the onset of the disorder was slightly earlier in patients with a family history of epilepsy than in the general colony population.

The frequency of seizures covered a wide range, but an arbitrary classification of eight categories was set up to per-

mit an analysis of the question. The data on this point are summarized in Table VI.

Unquestionably, institutionalized epileptics have a greater frequency of seizures than non-institutional epileptics because of the tendency to care for epileptics at home as long as seizures are not too frequent. However, as soon as they become more and more frequent, efforts are made to have the person

TABLE VII.—DEATH RATE OF POPULATION OF MICHIGAN FARM COLONY,
1915-1932

<i>Year</i>	<i>Average population</i>	<i>Deaths</i>	<i>Death rate (per 1,000)</i>
1915.....	135	8	59.2
1916.....	193	13	67.3
1917.....	335	60	179.1
1918.....	395	78	197.4
1919.....	477	68	167.7
1920.....	504	69	136.9
1921.....	544	41	75.3
1922.....	661	29	43.8
1923.....	659	53	80.4
1924.....	699	62	88.7
1925.....	734	49	66.7
1926.....	837	62	84.4
1927.....	849	60	70.6
1928.....	833	69	82.8
1929.....	784	69	88.0
1930.....	789	54	68.4
1931.....	819	76	82.8
1932.....	856	65	75.9
	11,103	985	88.7

institutionalized, partly in the hope of alleviating the condition and partly because the burden of care becomes too great for the home.

The death rate for the institution, in common with hospitals of this type, is exceedingly high. The range of rates per 1,000 patients, from 1915 to 1932 inclusive, varies from 197.4 in 1918 to 43.8 in 1922, with an average over the eighteen-year period of 88.7 per 1,000 patients (Table VII). During the last ten years, with a larger average population, the institution tends to have a more uniform rate of about 80 per 1,000 patients.

Presenting this data in somewhat tangible form based on

age groups and distribution per 1,000 deaths, Table VIII indicates that the institutionalized group at Wahjamega generally does not reach an advanced age, since 80.8 per cent died before the age of fifty-five. For contrast, the distribution by age of deaths per 1,000 in the population at large is presented. This comparison places additional emphasis on the deaths in the colony group at a relatively early age. Adjusted to standard populations, this tendency would be brought out

TABLE VIII.—AGE AT TIME OF DEATH OF PATIENTS IN MICHIGAN FARM COLONY *
AS COMPARED WITH GENERAL POPULATION AND POPULATION OF INSTITUTIONS
FOR EPILEPTICS, 1923

Age	Number of patients in colony	Distribution per 1,000		
		In colony	In general population	In U. S. insti- tutions for epileptics
Under 5 years.....	1	0.9	148.6	12
5 to 9.....	5	4.7	18.0	34
10 to 14.....	23	21.4	13.5	52
15 to 19.....	76	70.8	23.6	107
20 to 24.....	140	130.1	31.7	81
25 to 29.....	144	133.8	32.4	96
30 to 34.....	119	110.3	33.3	86
35 to 44.....	192	178.5	86.4	179
45 to 54.....	169	157.1	112.8	144
55 to 64.....	113	105.	142.3	91†
65 to 74.....	68	63.2	174.2	34
75 years and over.....	24	22.3	181.5	53‡
Unknown.....	2	1.8	1.6	29
Total.	1,076			

* Including 91 deaths in the first ten months of 1933.

† Sixty-five to 69 years.

‡ Seventy years and over.

in a more pronounced form since the colony population shows but 7 per cent under fifteen years of age, whereas the general population is composed of 29 per cent under fifteen years of age.

Perhaps a more suitable comparison is made with the age distribution of patients who died in institutions for epileptics in the United States, as recorded in the census of 1923. It may be recalled that the general United States epileptic census for 1923 agrees rather closely with the composition of the Michigan colony population.

The 1923 report showed 205 of each 1,000 deaths in institutions for epileptics to be under twenty years of age, as compared with 97.8 for the Wahjamega group. However, innumerable variables, such as the severity of the condition of patients, would modify the picture. Both groups indicate that in general institutionalized epileptics do not reach an advanced age.

A study of the period of time over which the patient had been institutionalized at the time of death reveals (Table IX)

TABLE IX.—YEARS OF RESIDENCE AT TIME OF DEATH OF 1,076 PATIENTS
IN MICHIGAN FARM COLONY

<i>Years of residence</i>	<i>Number of patients</i>	<i>Per cent</i>
Less than 1 year.....	225	20.9
Less than 5 years.....	659	61.2
5 to 9 years.....	272	25.3
10 to 14 years.....	123	11.5
15 to 17 years.....	22	2.0

that 20.9 per cent had been hospitalized less than one year; further, that 61.2 per cent had been institutionalized less than five years at the time of death.

A general interpretation would suggest that too often no attempt is made to institutionalize epileptic persons until it is too late for them to benefit from institutional care.

The period of time over which seizures had extended at the time of death is of social and economic significance (Table X). Data showed that no patients had had seizures for less than two years and that one person had had seizures over a period of seventy-seven years at the time of death.

In Table X the data on this point are distributed by five-year periods. Of the 611 cases on which definite data were available, 37.3 per cent had had seizures for twenty-five years or more at the time of death and 70.7 per cent had had seizures over a period of fifteen years or more.

Death certificates, giving the cause of death in 1,061 cases,¹ listed epilepsy as the primary cause in 646, or 60.9 per cent. (See Table XI.) This rather contradicts the opinion held by many that epileptics do not die of epilepsy as a direct cause.

¹ In 15 cases the cause of death was unascertained.

Of the 415 deaths from primary causes other than epilepsy, epilepsy was given as a contributing cause of death in 146, or 13.7 per cent of the total 1,061. Thus, according to the death certificates, epilepsy was either a primary or a contributing cause in 74.6 per cent of all deaths.

The principal causes of death other than epilepsy are listed in Table XII. The specific death rates for these are unusually high, due in part to the age distribution in the colony population and to the general lowered physical tone of a large number of the colony population. Other factors may be operative, but with our present knowledge the relationship is not clear.

TABLE X.—PERIOD OVER WHICH SEIZURES HAD EXTENDED AT TIME OF DEATH OF PATIENTS * IN MICHIGAN FARM COLONY

<i>Period of seizures</i>	<i>Number of patients</i>	<i>Per cent of total</i>
Less than 5 years.....	20	3.3
5-9.	61	10.0
10-14.	98	16.0
15-19.	102	16.7
20-24.	102	16.7
25-29.	54	8.8
30-34.	53	8.7
35-44.	54	8.8
45-54.	41	6.7
55-64.	14	2.3
65-74.	11	1.8
75 and over.....	1	0.2
Total.	611	100.0

* Not including 565 cases on which definite data were not available.

The lack of general facilities at the colony makes it impossible to admit epileptic persons immediately upon commitment. The waiting list at the time of study (1933) consisted of a total of 243 commitments from the general population (152 males and 91 females). At the same time various state institutions in Michigan had a total of 332 patients—186 males and 146 females—awaiting transfer to the colony.

The distribution of ages in the colony waiting list ranged from one year to eighty-one years, 45.5 per cent being under fifteen years of age as compared with 7 per cent in the colony population. Further, 62.3 per cent were under twenty years

of age as compared with 18 per cent in the colony population. The lack of facilities at the colony for giving special care to the younger age group explains, in a large measure, the disproportionately large number in the lower age groupings of the waiting list.

Of the 243 commitments directly from the state at large, 44 per cent had had their names on the colony waiting list for less than one year, while 56 per cent had been listed more than a year. Further, analysis revealed that 24.3 per cent

TABLE XI.—DEATHS DUE TO EPILEPSY AMONG 1,061 PATIENTS IN MICHIGAN FARM COLONY

<i>Cause of death</i>	<i>Number of deaths</i>	<i>Per cent of all deaths</i>
Epileptic degeneration.	376	35.5
Status epilepticus.	137	12.9
Died during seizure.	105	9.9
Exhaustion following seizure.	28	2.6
Total.	646	60.9

had been on the waiting list more than three years and that 6.6 per cent had been listed for more than five years. Six commitments had been on the waiting list for more than six years.

Incidence of Epilepsy in State Institutions.—The incidence of epilepsy in state institutions throws some interesting light on epilepsy among special groups. A survey of seven hospitals for mental disorders, with a combined population of 12,597, revealed 221 cases diagnosed as epileptics by the medical staffs of these institutions. The incidence of epilepsy in the combined hospital population was 1,754 per 100,000, or 1.8 per cent. The incidence in each separate institution in this group varied but little from this rate with one exception—the hospital for the criminally insane. This institution had an incidence of epilepsy of 3,079 per 100,000, or 3 per cent.

The home and training school at Lapeer had a population of 3,460 at the time of the survey. This institution cares for mental defectives of all classifications and grades, a large percentage being in the idiot and imbecile classes. The Lapeer training school had a total of 309 epileptics in its population and an incidence of 8,931 per 100,000, or 8.9 per cent.

The training school at Northville admits only subnormals with intelligence quotients between 60 and 80. Thus the group is composed of the higher type of subnormals. This institution, at the time of the survey, had a population of 703, of which six were epileptics.

Analysis showed that the incidence of epilepsy in Lapeer was 8,931 per 100,000, or 8.9 per cent, and the incidence at Northville 853 per 100,000, or 0.8 per cent. Thus the group of higher-grade subnormals had a much lower incidence of epilepsy than the group of lower-grade subnormals. As we have observed, epilepsy itself may have a retarding effect upon the mentality, thus being a factor that tends toward a lower-

TABLE XII.—PRINCIPAL CAUSES OF DEATH OTHER THAN EPILEPSY AMONG
1,061 PATIENTS IN MICHIGAN FARM COLONY *

<i>Cause of death</i>	<i>Number of deaths</i>	<i>Rate per 100,000</i>
Pneumonia.	104	936
Diseases of the heart.	87	783
Tuberculosis.	66	594
Nephritis.	28	252
Cerebral hemorrhage.	26	234

* Population 11,103.

grade mentality in many cases, yet the high incidence at Lapeer seems to indicate that the disease is rather closely associated with a generally defective nervous system.

Three state prisons were surveyed to determine the incidence of epilepsy in the prison population. The incidence for the three separate prisons varied but little. The combined population of the three was 7,480 with a total of 19 epileptics, an incidence of 254 per 100,000. This figure no doubt is a fairly close indication of the extent of epilepsy in Michigan's prison population. Whether it expresses the situation in the criminal class in general is a question that will have to await further study. Certainly, it does not support the opinion held by many that a disproportionately large number of epileptics are to be found in prisons.

The 72 county infirmaries from which data were obtained had a population of 9,655, and a total of 85 epileptic persons, giving an incidence of 829 per 100,000 inmates or 0.8 per cent for the infirmary population.

Epilepsy in the General Population.—In order to obtain data relating to the general situation in regard to epilepsy in the state of Michigan, a thorough survey was made of nine counties in the northeastern section of the lower peninsula. These counties were selected because of excellent contacts with individuals and agencies in a position to be of direct assistance in the survey. In addition, this area has a fairly constant population,¹ and the nature of the population is satisfactory for the purposes of a general survey. About two-thirds of the population may be termed as indigenous, with

TABLE XIII.—INCIDENCE OF EPILEPSY IN VARIOUS INSTITUTIONS AND IN THE NINE-COUNTY AREA SURVEYED

	Rate per 100,000
In nine-county area.....	210
In penal institutions.....	254
In all hospitals for mental disorders.....	1,754
In hospital for the criminally insane.....	3,079
In home for low-grade mental defectives.....	8,931
In home for high-grade subnormals.....	853
In county infirmaries.....	829

the remaining one-third composed largely of Polish, Canadian, and Scandinavian immigrants and their families.

Data were rechecked to insure maximum of accuracy in all respects.

The survey showed that these counties had a total of 46 epileptic persons committed to state institutions (including two persons on the farm-colony waiting list). In the population at large there were 108 definitely epileptic persons, giving the entire area a total of 154 epileptics. On the basis of a population of 73,056, the general incidence of epilepsy would be 210 per 100,000, or 0.2 per cent for this area.

Of the cases of epilepsy in the population at large, 62 per cent were or had been under medical care.

The sex incidence in this group of epileptics was males 53.9 per cent, females 46.1 per cent. This ratio may be compared with the findings of Gowers² (males 48 per cent and females 52 per cent); of Patrick and Levy³ (males 62 per

¹ It had a slight decline from 80,816 in 1900 to 73,056 in 1930.

² See note 2, page 450.

³ "Early Convulsions in Epileptics and Others," by H. T. Patrick, M.D.,

cent and females 38 per cent; and of Spratling¹ (males 60.1 per cent and females 39.9 per cent).

To obtain a comparative study of the incidence of epilepsy among special types or groups of people in relation to the incidence of epilepsy in the general population, a composite analysis was made. This is shown in Table XIII.

From this analysis it appears that the incidence of epilepsy in the general population is less than that in any group studied. However, the incidence of epilepsy in penal institutions was but slightly higher than that of the general population.

TABLE XIV.—ESTIMATE OF EPILEPTIC PERSONS IN MICHIGAN

	Number	Per cent of total
In epileptic colony	1,002	9.9
On colony waiting list (in general population)	243	2.4
In hospitals for mental disorders	221	2.1
In homes for mental defectives	315	3.0
In penal institutions	19	0.2
In county infirmaries	85	0.8
In population at large	8,281	81.5
Total.....	10,166	99.9

An application of the rate found in the nine-county area to the state of Michigan as a whole would indicate that there are approximately 10,166 epileptic persons in the entire state. Table XIV gives an approximation of the distribution on this basis.

SUMMARY

1. The average population of the Michigan Farm Colony for Epileptics varied from 135 in 1915 (the first complete institution year) to 856 in 1932. The colony population is dependent upon the facilities available at the colony and not upon the incidence of epilepsy in the general population.

2. Of the 1,002 colony patients in August, 1933, 43 per cent had been residents at the colony for less than five years, 22 per cent from five to nine years, 21 per cent from ten to fourteen years, 14 per cent from fifteen to nineteen years. That 35 per cent of the patients had been in residence ten years or more is

and D. M. Levy, M.D. *Journal of American Medical Association*, Vol. 82, pp. 375-81, Feb. 2, 1924.

¹*Epilepsy and Its Treatment*, by W. P. Spratling, M.D. Philadelphia: W. B. Saunders and Company, 1904.

an indication of the advantages of colony care in providing an environment to which the epileptic can adjust himself permanently.

3. In regard to the civil status of colony epileptics, data showed that 82 per cent were single. A proportionately higher number of females than of males were found in the married, widowed, and divorced groups. The indication is that male epileptics are less likely to marry than female epileptics, possibly because of the extreme insecurity of the male epileptic in the economic world.

4. Staff diagnosis as to types of epilepsy showed 85 per cent idiopathic, 7 per cent traumatic, 5 per cent symptomatic, and 3 per cent hereditary.

5. Only 7 per cent of the colony patients were under fifteen years of age while 80.2 per cent were between the ages of fifteen and fifty-five. This light distribution in the lower age groups was largely due to a lack of facilities at the colony for caring for children.

6. A total of 21.9 per cent of the patients had received no formal education before admission to the colony and 91.2 per cent of the entire group had not entered high school. The low educational attainment of this group may be attributed to the frequent association of mental deficiency with epilepsy and also to the fact that because of his affliction the epileptic does not find school a very congenial place.

7. In general, counties with well-established social agencies were apt to have a proportionately higher number of persons at the colony than those without such agencies. The general rate for the state was 27 patients per 100,000 of the general population.

8. The position of the patient in the family and the size of the family seemed to have no particular significance.

9. The occupations of the fathers of the patients indicated that, as a whole, the patients were fairly representative of the lower-income group in the general population.

10. No appreciable differences were found in the family histories of male as against female patients in regard to such disorders as epilepsy, feeble-mindedness, insanity, chorea, and so forth.

11. Data showed that maternal disorders or defects of this

type tended to manifest themselves more often than paternal disorders.

12. In the family histories, epilepsy appeared more often than any other disorder, 16.3 per cent of the patients having a family history of epilepsy.

13. Feeble-mindedness and insanity appeared of significance in the family histories, suggesting the association of epilepsy with deficient and unstable nervous systems.

14. Syphilis and alcoholism, contrary to public opinion, appeared to be unimportant.

15. The histories of patients previous to admission to the colony showed an unusually high frequency of disorders of the nervous system and of special sense organs. A tendency toward defective nervous systems is again suggested.

16. Of the 919 colony patients for whom data on this point were available, 31.8 per cent had had their first seizure before the age of five and 83.5 per cent had had it before the age of twenty, suggesting an early onset of epilepsy. The social and economic importance of this factor is significant.

17. The factor of sex appeared to be of no significance in onset of seizures, frequency of seizures, family history, or patient history.

18. Patients with a family history of epilepsy showed no significant variation from the general colony group as regards age of onset and frequency of seizures, possibly suggesting that epilepsy classified as "hereditary" is not essentially different from any other epilepsy, the mere fact of epilepsy in the family history being the sole basis for this classification.

19. An unusually high death rate and a relatively short life appeared to be characteristic of institutionalized epileptics.

20. At the time of death, 20.9 per cent of the patients who had died had been institutionalized less than one year and 61.2 per cent had been institutionalized less than five years. The added fact that 15.4 per cent of the patients had one or more seizures per day at the time of admission to the institution suggests that too often people turn to colony care as a last resort and only after the problem has become too difficult for the home.

21. A total of 60.9 per cent of the death certificates listed epilepsy as the primary cause of death, and of the remaining, 34.9 per cent had epilepsy listed as a contributing cause of death, indicating that despite popular opinion to the contrary, a large proportion of epileptics die as a result of epilepsy.

22. Of the waiting list of 575—243 committed from counties and 332 awaiting transfer from other state institutions—45.5 per cent were under fifteen years of age, indicating a lack of facilities for the care of epileptic persons in the lower age groups. In addition, of the direct county commitments on the waiting list, 56 per cent had been on the list for more than one year and 6.6 per cent had been listed for more than five years, an indication of a general lack of adequate provision for epileptic persons in need of institutional care.

23. A survey of a nine-county area in the northeastern section of the lower peninsula revealed an incidence of epilepsy of 210 per 100,000 population and a sex incidence for this group of epileptics of 53.9 per cent males and 46.1 per cent females. Of the epileptics in the general population, 62 per cent were or had been under medical care.

24. The incidence of epilepsy per 100,000 for various groups and institutions in the state was as follows: In general state population, 210¹; in penal institutions, 254; in home for high-grade mental subnormals, 853; in county infirmaries, 829; in hospitals for mental disorders, 1,754; in hospitals for the criminally insane, 3,079; in home for low-grade mental defectives, 8,931. The evidence here is that among the criminal class epilepsy is not as prevalent as is so often asserted. Further, the association of a defective nervous system with epilepsy is emphasized.

25. Estimated on the basis of an incidence of 210 per 100,000 and a population of 4,842,000, the number of epileptic persons in the state of Michigan at the time of this study was 10,166. Of these, 9.9 per cent were under colony care; 2.4 per cent were on the colony waiting list, but living in general society; 2.1 per cent were in state hospitals for mental disorders; 3 per cent were in homes for mental defectives; 0.2 per cent were in penal institutions; 0.8 per cent were in county infirmaries; and 81.5 per cent were in the community.

¹ Based upon the nine-county survey.

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